AMENDMENTS TO THE DRAWINGS

Attached are six (6) sheets of Replacement Figures 1-10 for Figure 1-10 as originally filed.

Attachment: Replacement Sheets (6)

REMARKS/ARGUMENTS

Claims 20-36 are pending. By this Amendment, claims 20, 22-30, 32 and 33 have been amended, and new claims 34-36 have been added. In addition, a new Abstract has been provided and replacement Figures 1-10 are provided herewith Reconsideration in view of the above amendments and the following remarks is respectfully requested.

In paragraph 2, the Abstract was objected to under MPEP §608.01(b). By this Amendment, a new Abstract is provided which avoids implied phrases and does not repeat information in the title. Reconsideration and withdrawal of the objection are respectfully requested.

In paragraph 3 of the Office Action, the drawings were objected to under 37 CFR §1.84(p)(5). This objection is respectfully traversed as the description does not mention reference number 50. In any event, replacement Figures 1-10 are provided herewith as replacement sheets 1-6. Reference number 50 no longer appears in relation to Figure 6.

Reconsideration and withdrawal of the objection are respectfully requested.

Claims 20-24 were rejected under 35 U.S.C. §101 as being directed to non-statutory subject matter. This rejection is respectfully traversed as claims 20-24 are clearly directed to a device for monitoring an opaque body, i.e., the opaque body is not positively claimed. In any event, at least claim 20 does not specify that the opaque body is a human or part of a human in which case the rejection is clearly improper. Moreover, care has been taken to amend the claims so as to avoid any positive recitation of the human body.

Reconsideration and withdrawal of the rejection are respectfully requested.

Claims 20-32 were rejected under 35 U.S.C. §102(b) over Mawhinney (U.S. Patent No. 4,991,585). This rejection is respectfully traversed.

Claim 20 is directed to a device for monitoring an opaque body by categorising scattering characteristics of said opaque body at microwave frequencies. The device comprises at least one low power microwave emitter for locating adjacent said opaque body; a microwave detector for detecting fluctuations in said scattering characteristics from said opaque body; and a signal processing means for analysing said fluctuation from said opaque body, to calculate scattering parameters for providing a measure indicative of said fluctuations and said scattering characteristics.

Mawhinney does not teach or suggest this subject matter. Mawhinney discloses a processing method which uses a reflection characteristic rather than "scattering characteristics" as set forth in claim 20. Scattering characteristics are more versatile and have a greater dimensionality than a phase and magnitude measurement relating a transmitted and reflected signal.

One of ordinary skill in the art would understand "scattering parameters" to be a term of art which is mostly used for networks operating at radio and microwave frequencies. It would be further understood the scattering parameters are typically used when expressing electrical properties of the system such as gain, return loss, voltage standing radio ratio (VSWR), reflection coefficient and stability. In the context of scattering parameters, scattering refers to the effect of discontinuities within a transmission line on traveling currents and voltages, for example, when a wave meets an impedance differing from the line's characteristic impedance. It would be appreciated that scattering parameters are readily represented in matrix form and obey the rules of matrix algebra. It would be further appreciated that scattering parameters in context of the present disclosure are distinct from a measure of a reflection characteristic disclosed by Mawhinney that comprises only magnitude and phase. By way of example only, scattering

parameters are discussed further in wikipedia at the following URL

'http://en.wikipedia.org/wiki/Scattering_parameters'.

On the basis of "scattering parameters" being a term of art, a S-parameter matrix is a particular form of scattering parameter. The S-parameter matrix describing an n-port network will be square of dimension 'N' and will therefore contain N^2, elements. At the test frequency each element or S-parameter is represented by a unitless complex number. By way of example, S-parameter matrix for a two-port network can be expressed in the following equation, and represents the relationship between the reflected, incident power waves.

$$\begin{pmatrix} b_1 \\ b_2 \end{pmatrix} = \begin{bmatrix} s_{1,1} & s_{1,2} \\ s_{2,1} & s_{2,2} \end{bmatrix} \bullet \begin{pmatrix} a_1 \\ a_2 \end{pmatrix}$$

This represents the relationship between the reflected and incident power waves at each of the network ports, 1 and 2, in terms of the network's individual S-parameters, s_{11}, s_{12}, s_{21}, s_{22}. Each two-port S-parameter has the following generic descriptions: s_{11}, is the input port voltage reflection coefficient, s_{12}, is the reverse voltage gain, s_{21}, is the forward voltage gain, and s_{22}, is the output port voltage reflection coefficient.

It would be further appreciated that numerous parameter matrices can be defied by transforming the S-parameter matrix, these include the scattering (transfer) parameters. By way of example the scattering transfer parameters for a two-port network can be represented in the following equation.

$$\begin{pmatrix} b_1 \\ a_1 \end{pmatrix} = \begin{bmatrix} t_{1,1} & t_{1,2} \\ t_{2,1} & t_{2,2} \end{bmatrix} \bullet \begin{pmatrix} a_2 \\ b_2 \end{pmatrix}$$

A person skilled in the art would recognise that scattering parameters for more complex n-port networks (comprising a plurality of sub-networks) can be calculated using matrix algebra

applied to the scattering parameters of the sub-networks, and can be utilised in the design and testing of n-port networks.

This distinction will be further borne out by detailed comments, as provided below.

Mawhinney teaches recovery of a signal output through use of a mixer 208. The output for mixer 208 includes all beat-frequency components derived from beating the signal applied to its second input from antenna element R against the carrier signal applied to its first input from power splitter 206. See column 3, lines 49-55.

However, Mawhinney teaches a method of further isolating the reflected frequency components from those arriving via a "leakage path" 224, in part by relying on the inherent field pattern overlap between the Antennas 'T', 'M' and 'R' (Mawhinney col 4 lines 31-47). Mawhinney applies a further phase-shift derived from F_o to the propagating signal intermediate the time it is transmitted from the transmitter antenna 'T' and received at the receiver antenna 'R' (Mawhinney col 4 lines 12-18). By doing this, Mawhinney teaches the modulation, or shifting, of the reflected signal about the frequency F_o. The resultant signal received at the receiver antenna 'R' therefore contains a component transmitted via the leakage path 224 and a desired component transmitted via the reflected paths 220 and 222 (Mawhinney col 4 lines 18-23), as can be expressed by the following example equation.

$$V_R = \left[A_1 \cos\left(\omega_{RF} t + \phi_{reflected}(t)\right) + A_2 \cos\left(\omega_{RF} t + \phi_{leakage}(t)\right)\right]$$

When applied to the mixer, the phase components can be extracted in a similar manner as disclosed in Sharpe (discussed below).

A person skilled in the art would understand that, the phase component $\phi_{reflected}(t)$ associated with the reflected paths 220 and 222 is modulated about the frequency F_o, whereas the phase component $\phi_{leakage}(t)$ associated with the leakage path 224 would have no further modulation (Mawhinney col 4 lines 18-23, and col 4 lines 56-67). Provided the phase components are spectrally distinct, the reflected components can be isolated using the narrow band filter 214 (Mawhinney col 3 lines 54-69, and col 4 line 68 to col 5 line 3). The application of the narrow band amplifier 216 and envelope detector 218 (Mawhinney col 3 lines 58-60) is simply a known Amplitude-Modulation technique for extracting a modulated signal.

Applicants respectfully assert that Mawhinney only teaches the processing of a beat-frequency as expressed in the form $A\cos(\phi(t))$ above, and does not teach categorising scattering characteristics (or the calculation of scattering parameters) as recited in claim 20 and similarly in independent claim 25.

In summary, Mawhinney rely on the principle that breathing and heart beat produce measureable phase changes in electromagnetic waves as they reflect off the human being (column 1, lines 52-56). Thus, Mawhinney does not teach a device for monitoring an opaque body by categorising scattering characteristics of the opaque body at microwave frequencies which includes a signal processing means for analysing the fluctuations from the opaque body to calculate scattering parameters for providing a measure indicative of said fluctuations in said scattering characteristics as recited in claim 20.

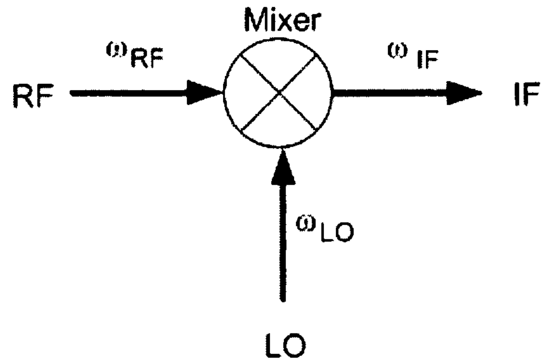
Claims 21-24 and 26-31 are dependent on claims 20 or 25, respectively, and are patentable by virtue of that dependency, in addition to the further features they recite. In addition, in respect to claims 27 and 28, clarification is requested as these claims are purportedly

rejected based on Mawhinney in paragraph 7 of the Office Action, yet the specific treatment of claims 27 and 28 involves a discussion of the "Allen" reference. Apparently, claims 27 and 28 are not rejected under Mawhinney. In addition, claims 27 and 28 are not apparently rejected under the combination of Mawhinney and Allen. Thus, reconsideration and withdrawal of the rejection are respectfully requested.

Claim 33 was rejected under 35 U.S.C. §103(a) over Mawhinney in view of Sharpe et al. (U.S. Patent No. 4,958,638). This rejection is respectfully traversed.

Sharpe discloses a device that detects motion of a target with an electromagnetically-reflective surface by measuring the motion related time-delay of a reflected signal (Sharpe col 5, line 16-20). This time-delay is measured as a function of phase changes as indicated by the range function $R(t)$ expressed in equation 4 (Sharpe col 5, line 68). This range function is a 'real' function with limitations imposed so that phase ambiguities are avoided (col 6, line 68). Sharpe further teaches the use of a double balanced mixer (24) for demodulating the RF (radio frequency) signal to an IF (intermediate frequency) signal which is further demodulated to extract the phase information (Sharpe col 6, line 56-60).

It would be appreciated that this mixer is used in Sharpe for demodulating the RF (radio frequency) signal to an IF (intermediate frequency) signal. Referring to the figure below, a mixer is shown to receive inputs in the form of an RF signal and a LO (local oscillator) signal thereby to produce an output IF signal.



The output IF signal, in general terms provides a multiplication of the RF signal, for example $A_{RF}\cos(\omega_{RF}t+\phi(t))$, and the LO signal, for example $A_{LO}\cos(\omega_{LO}t)$, to provide an IF signal comprising a "sum and difference" frequency signal, as expressed by the following equation.

$$\begin{aligned} V_{IF} &= [A_{RF}\cos(\omega_{RF}t+\phi(t))][A_{LO}\cos(\omega_{LO}t)] \\ &= \frac{A_{RF}A_{LO}}{2}[\cos((\omega_{RF}+\omega_{LO})t+\phi(t))+\cos((\omega_{RF}-\omega_{LO})t+\phi(t))] \end{aligned}$$

It would be further appreciated that Sharpe teaches the LO and RF signals originate from the same source (12), thereby having substantially the same frequency and differing by a phase term indicative of the time-delay of the reflected signal (Sharpe col 6, line 49-53).

The high frequency component $\cos((\omega_{RF}+\omega_{LO})t+\phi(t))$, being the "sum frequency signal", is subsequently filtered out. This leaves the phase component $A\cos(\phi(t))$, being the "difference frequency signal", from which the range function $R(t)$ is derived (*Sharpe* col 8, line 30-36).

This is achieved by applying synchronous, or coherent, detection whereby amplitude and phase is recovered (Sharpe col 8, line 51-52). "The phase of the demodulated return signal varies as a function of target motion. Therefore, the 'I' (in-phase) and 'Q' (quadrature) signals,

71 and 73, that are output by the synchronous detector 58 are not true DC terms. Instead, these signals occupy a frequency band related to that of the motion being detected (Sharpe col 10, line 41-46, see abstract & col 6, line 32-37).

Applicants respectfully assert that Sharpe only teaches measuring motion related time-delay, and does not teach categorising scattering characteristics (or the calculation of scattering parameters) as recited in claims 20 and 25.

Thus, neither Mawhinney nor Sharpe et al. teaches or suggests the claimed scattering parameters as recited in independent claims 20 and 25 which are distinct from a measure of reflection characteristic disclosed by Mawhinney and Sharpe et al. that comprise only magnitude and phase. Mawhinney and Sharpe et al. also fail to teach or suggest alternative approaches to calculating movement of internal portions of bodies. Mawhinney and Sharpe et al. only teach detecting motion related time delay or equivalently motion related phase changes, of a reflected signal.

Reconsideration and withdrawal of the rejection are respectfully requested.

Claims 34-36 are presented for the Examiner's consideration.

In view of the above amendments and remarks, Applicants respectfully submit that all the claims are patentable and that the entire application is in condition for allowance.

Should the Examiner believe that anything further is desirable to place the application in better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,

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PTB:jck
Attachments:
Replacement Abstract
Replacement Figures 1-10 (6 sheets)

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